

AVIATION WEEK

MARCH 23, 1953

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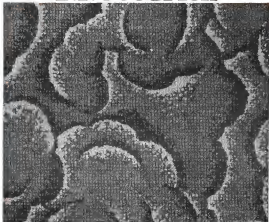


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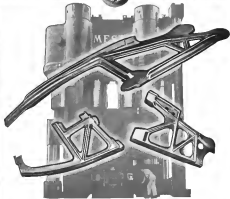
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have created engineering problems, the solution of which has required larger and larger forgings of high-strength aluminum alloy. Examples shown above are forged structural members used in a modern military bomber, the largest mass flow seven feet four in. diam. and forged in an 18,000-ton press, the biggest ever built in this country.

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NEWS DIGEST



LARGEST MASS FLIGHT of propeller-driven fighters in the continental U.S. was made Mar. 7 along USAF graduation exercises at Nellis AFB Air Training Command School, Las Vegas, Nev. Shown above are some of the 90 Lockheed F-100s that made

the flight, 58 North American F-100s also participated. Fifty of the pilots were USAF students, 12 were RAF students and the remainder were instructors. The planes took off at 10-second intervals, made 90 turns, eight and landed at the same airfield.

Domestic

Child Announcements has started enforcement proceedings against owners of the nine companies affiliated with North American Aircraft Systems, alleging they dodge CAR's flight-recency restrictions on business volume of individual mechanics by "pooling" of four separate entities. Full description of North American's largest non-scheduled airline sales operation, appeared in *Aviation Week* (Aug. 16, 1952, p. 61).

Eastern Air Lines was ordered in a federal court test case last week to pay \$65,800 damages to the children of two persons killed in the 1949 collision of an EAL DC-4 and a Bolina F-51 over Washington National Airport, making the carrier liable for claims of \$10,515 in future care of \$3 other persons in the crash.

Piper Aircraft is planning to drill for oil on farmland surrounding its Lock Haven, Pa., plant, according to a corporation announcement adapted recently by *Piper stockholders*.

UAW-CIO workers struck last week at General Electric's Franklin, Conn., jet engine plant, (*Aviation Week* Mar. 5, p. 15) when a walkout at AFL mechanics two days earlier had tied up a large share of Air Force propeller production.

Major talks between Sikorski Aircraft and Boeing Tiger Line have been revived by the threat of growing competition from combination passenger freight carriers.

Helicopters operated by New York Airways are transferring mail between airfields at the metropolitan area's little-used International La Guardia and

Newark Airports, eliminating preceding delays in the airfield's post office.

Mrs. Maud Martin, 89-year-old mother of aircraft manufacturer Glenn L. Martin, died Mar. 14 in Baltimore. She was one of the first women to fly, making a flight 41 years ago in a plane built and piloted by her son.

A **\$400,000 Air Force contract** has been awarded to ACI-Bell Motors Co., Philadelphia, for production of 18 47 engine pods.

Seawater DC-3s, lost of Eastern Air Lines' fleet at the two-engine transport, have been purchased by Lowland Aeronautical Service, Fort Wayne, Ind., for leasing to companies and carriers.

Part of New York Authority recently accepted \$150,000 as increased federal aid for construction of a passenger terminal building and related facilities at Newark, N. J. Airport, lessening total federal obligations for the structure to \$1,650,000.

Capt. Alvin H. Dorel, New lighter first air ship project, died Mar. 10 at Newport, R. I.

Maj. Gen. Kenneth E. Webber has received command of the Eastern Air Proving Ground, New York, replacing retired Maj. Gen. Arthur Thomas.

National Association of Manufacturers' Representatives recently elected Louis J. Sculler as president. Also named: Dan S. Brinkman, vice president; Robert Gosholt, secretary; and Robert Sill, treasurer.

Financial

Seaboard & Western Airlines reports

a record net income and capital gain of \$1,759,474 after taxes in 1952 and an all-time high operating revenue of \$82,062,495.

Aeromex Manufacturing Corp. earned a profit of \$852,152 last year from selling more than \$12 million. The Middlebrook, Okla., company's backlog at the end of the year is reported at nearly \$25 million.

Continental Air Lines has declared a dividend of 12 1/2 cents per share on 400,000 shares of common stock outstanding.

Saba Aircraft Co., San Diego, is seeking its regular quarterly common stock dividend this month from 25 to 27 cents a share and also declared on common common stock dividend of 15 cents per share.

International

Portuguese Air Lines reported last week that net profits for 1952 totaled \$612,512 from operating revenues of \$15,807,175 and non-operating income of \$316,554.

Swissair's revenue last year added up to \$15,084,612, a 16 1/2 percent increase over 1951's total of \$13,815,598.

New air transport company is being founded by Portugal's government to replace TAP Portuguese Airlines.

Aerolineas guineas apply for airframe operating in Venezuela will be received by a \$15,111,636 expansion of Circle Pitotaleco Corp.'s release at Ameyo on the Portuguese Peninsula.

Milk Belling, founder and president of Hispano-Suiza Co., died Mar. 14 in Geneva.



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March 23, 1953

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CRUISE CUTS VULCAN LANDING—During its ribbon-type landing chute, the four-engine Vulcan following bomber down an landing roll on a snow-covered runway. Note that the plane's nose-type is broken and extended vertically above and below the wing surface. The plane's nose is high above the ground on its long, multi-wheel landing gear.

New Developments in Military Aviation



SUPER CONSOLE LETS HEAVY LOADS—The New Lockheed C-124, military version of Super Constellation, recently took off at 141,000 lb. gross weight, 74 tons more than its normal maximum load. Photographs are from Wright R3510 Turbo Compound engines of 3,210 hp each, turning Hamilton Standard Hydromatic props. Airframe is to get Turbo Compound Super Constellation engines.



NEW CARRIER DECK TESTED—Four photos of USS Anderson's angled deck undergoing tests. Shaded white line (photo above) indicates deck. At right in AD Shyler takes off.



INDUSTRY OBSERVER

Western military men expressed surprise at the evidence of good craftsmanship and maintenance practice on the captured MiG. And this craftsmanship was coupled with a very light construction—17,000 lb. overall weight. Glorians see the MiG evidence will give support to those in the U. S. and Britain playing the issue of light or stripped-down interceptors.

SHARF officers, Ball-Bruce and Glorian technicians have gone over the captured MiG-15 in Dayton (this month), with perfect interest in uncovering, centering on the type of metal used in composite blades of the jet's VK-1 engine—Russian version of the Ball-Bruce J4495 Nene, exported to the Soviet in 1946. It is assumed that Western investigators also will fly the MiG before returning it to Poland.

Pentagon is battling with issues of further permanent shifts aimed at cutting back future production of fast-shockdown types and diverting funds to accelerating production of money aircraft types. So far no final contract program has emerged from either USAF or Navy's Ruler.

USAF reports that about 15 Wright J44 turbojets had to be removed from Republic F-64F Thunderbolts and returned to the Wright plant at Wood-Ridge, N. J. for "engine repairs" to the compressor section. USAF expects to have the engines back at Republic that work for continued flight testing of early production model Thunderbolts.

Northrop has delivered its first modified F-60C Scorpions to USAF incorporating structural changes to eliminate wing failures previously encountered at high speeds and low altitudes (Aviation Week, Dec. 1, p. 14). USAF is testing F-60Cs from its test fleet where they have been grounded since last fall to Northrop's Hawthorne plant where the modifications work is being done.

Missile production ends USAF recently permitted Northrop to increase size for the Hawk, a golden brother type powered by a turbo jet engine. Hawks have been flown in C-124 transports from Northrop's Hawthorne plant to Patrick AFB in Florida for flight testing.

Glenn Jacobs, following all-weather fighter, recently got a five-year bid from USAF test pilot Lt. Col. Dick Johnson, former holder of the world speed record, who flew the plane for evaluation in the all-weather production program. Third-level prototype is now flying but first production models are not expected for another year. Later all these programs plan for the fourth is to finance manufacture by Fiat in Italy.

Shorlids plans another power increase for its BRS helicopter series, with a Wright R4400 rated at 1,125 hp scheduled for the BRS-4. The power increase over the 700 hp of the Wright R4300 now used in the BRS-3 will permit the copter to carry 10 combat-loaded troops plus crew.

Navy is planning to switch production of its powerplant (diamond) both being built by Chrysler and the Ford Lincoln Mercury Division in the Detroit area to production of the Ford & Whittaker Aircraft F-7 turbojet. Chrysler originally was scheduled to build the F-7WA, J44 and Ford the Whittaker J44. Now Navy needs additional J57 production capacity for its program of aircraft engines for the J44 (Aviation Week, Mar. 10, p. 15) because USAF has priority on J57 production programs at Ford's East Elizabeth plant and the Ford Aircraft Engine Division at Chicago.

Allison Division of General Motors Corp. is building large new facilities for development and testing of turbojets on a hundred-acre site near Indianapolis. New facilities eventually will house all Allison jet development facilities and will include eight new test cells, 350,000 sq. ft. of experimental shop, an engine transport test laboratory. The new test cells will be protected by bulletproof steel plate, with all fuel lines located externally.

WHO'S WHERE

In the Front Office

Joseph V. Mann, general manager of Corvus Wright Electronics and Columbus Project Division, has been elected a vice president of CWF.

H. Scott Hensley, Jr., and Anthony G. Brown, Jr., are new vice presidents of Bend Electric, Inc., Jamestown, Ohio. Brown is credited as the former partner in other ventures, various products. In Paul J. Paprock.

Harry E. Bower has been appointed vice president sales of Bristol Co., Watertown, Conn.

Changes

James F. Holsinger, former president of Southern Ohio Aviation Co., a general manager of Corvus Engineering Co., a new firm that plans to design aircraft and other aviation products. R. G. Nangle, for work that project engineer for the Air Force in the B-10, a chief engineer.

James T. Ray, former manager of Westcoast (Miss) Municipal Airport, has been named acting director of aviation for Philadelphia.

C. A. Sorenson has been appointed chief engineer of Air Associates, Inc., and C. R. Terry has been promoted to general manager of the Hamilton, N. J., company's Electronic Equipment Division.

John R. Schenckel has joined Rossmore Air Lines as director of public relations. Leonard C. Olson is National Airline's new director of regulations and procedures, operations department.

Gene B. Kowalski has been named vice-president of electronics at Tempo National Corp., Dallas. Other recent Tempo promotions: Leon W. Moore, assistant vice-president of electronics; Jack E. Crispin, superintendent of flight camp and modification; and Duane Beards, assistant night supervisor of night operations.

Gerald R. Thomas has been appointed assistant to the general sales manager of Tempo National Airlines, who moved to new jobs in TWA. Richard Monahan, electronic sales director, from Richard F. Schaefer, district sales manager, for TWA and H. G. A. Mohr, district sales manager. David F. Ford has been granted a leave of absence from TWA, to accept a post as general sales manager of Hinkley Air Lines.

G. E. Johnson has been appointed assistant to the general manager of Cherry Vought Aircraft, Dallas, and W. L. Hall has been promoted to assistant manager.

David M. Mason has been named assistant general manager of Perich Helicopter Corp., Miami, Fla.

Honors and Elections

Bruce Kalkoski, Alfred H. Towner, Gordon B. White, Jr., and Irving R. Clark have received General Electric's Charles A. Coffin Award for "outstanding achievement" in the aviation industry.



HAMILTON STANDARD... leader for years in propeller design and production, is supplying other equipment for such outstanding new aircraft as the United States Navy's McDonnell F3H jet fighter.

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Missile with a "one track mind" ... Bomber Defense

Defensive guided missiles launched from supersonic aircraft will depend upon electronic search that come in close to simulating known missile threat in key mechanism once desired. Important functions of these "weapons of the future" are typical of those entrusted to systems made by Arma Corporation.

Complex electronic and electromechanical con-

trols from Arma are an integral part of many of America's most advanced weapons. In basic research, design, development and manufacture, Arma Corporation has worked in close cooperation with the Armed Forces since 1915—and more recently, the Atomic Energy Commission. Arma Corporation, Brooklyn, N. Y.; Milwaukee, N. Y. Subsidiary of American Branch Corporation.

USAF Procurement Probe

Mass industry interest is focusing on the comprehensive investigation of Air Force's procurement program planned by a Senate Armed Services Investigative Subcommittee headed by Sen. Styler Rodgers.

First on the agenda: Kaiser-Fraser Corp. C-119 contract. Investigation on new design proposed work research. According to Chairman Rodgers, the subcommittee expects to open public hearings in a few weeks. It is anticipated that there will:

- Fit two major aircraft firms—K-F and Fairchild Dornier and Douglas Corp.—against each other. Fairchild officials have challenged the wisdom of diverting production of the C-119, developed by Fairchild, to K-F. Fairchild's next cost is now \$365,000 toward the end of a long production run. K-F's cost of \$1,200,000 for the first plane is expected to taper down to \$700,000 for the final plane.

The subcommittee expects to look into the feasibility of obtaining the uncompleted balance of the K-F contract to Fairchild.

Fairchild expects it could be producing planes on the K-F contract in a month, and with increased volume its per unit cost would go down.

- Ascertain whether the USAF's military staff, headed by Gen. Fleet Vandenberg, concurred with the civilian aircraft, then headed by former Secretary Thomas F. Watson and former Undersecretary John McGee, in letting the C-119 contract to K-F. There were widespread reports at the time that the Kaiser-Fraser contract involved only a sharp conflict between Vandenberg and Fairchild.

Other subjects on the subcommittee's agenda:

- Policy of establishing second sources of supply. This policy, followed by Army and Navy as well as USAF, has the most, as is the K-F case, of which the higher unit costs involved in never looking up costs is justified. Subcommittee is weighing objections by manufacturers. Performance is meeting production targets. Trying up where the Johnson Propulsion Subcommittee left off last year, the group plans to go into all aspects of aircraft production performance.

Scotch Bilateral Air Facts?

An transport industry so far shows only mild concern to the future threat facing international operations. Some 90 pilot licenses agreements covering inter national growth to U.S. carriers would be considered temporarily at least, by an amendment to the consultation proposed by Sen. John Breaux and cosponsored by 62 other senators.

If the constitutional amendment is adopted—which will require a two-thirds vote by the Senate and the House and ratification by three-fourths of the states—that is what would happen.

Washington Roundup



Sen. Styler Rodgers

- All existing bilateral executive air agreements not actually would be considered. They would be treated as effective when and if Congress passed legislation so providing.

- All bilateral negotiated after adoption of the constitutional amendment would require congressional implementation to remove the 1918 Civil Air Transport Act's requirement for full CAB hearings in the granting of certificates to foreign lines.

Chief airline concern so far seems to be that during the period of certification. Foreign governments would expect agreements, then given the most favorable terms for their airlines in negotiations.

Local Service Lines' Dilemma

Local service lines, which can't get off slowly until they support an essential plane for their operations, are faced with this situation:

- Major aircraft firms, with heavy military orders, have turned them down in development of a local service plane in financially too risky, particularly in view of the temporary status of local line certificates.

- Now, the proposal to take some of the risk out of the project by authorizing \$5 million government financing, introduced by Rep. Carl Albert, is faced with opposition from the aircraft industry. Manufacturers, responsible to the "defense" and "defense" attached, are opposed to government financing of commercial types. They feel that an exception would set a precedent.

Meanwhile, local lines' hopes rest on these possibilities:

- Development of the F-27 by Rockwell Aircraft Corporation (Parker). But availability is three years off. Shipment of licenses to Fairchild, U.S. version, for assembly with parts and accessories would not drive the heavy tariff on aircraft imports.

- Development of the C-32 by Cessna, Ltd. Local lines are now anxiously watching the drama of Cessna's bid to go into production.

- Development of a transport version of the Cessna 441 by Kaiser-Fraser Corp. K-F is now conducting the project. Government financing might be a necessary condition.

CIA Budget Future

Congressional action on Civil Aeronautics Administration's fiscal 1974 budget proposals to be met and dealt, with reductions down the line.

- House Appropriations Subcommittee on Commerce, headed by Rep. Cliff Cleveland, is making first time on hearings. They will set a record for brevity.

- Committees are usually attacked with both CAA and CAB administration, and the filing that has caused previous hearings isn't expected.

- CAA isn't expected to accept local opposition to congressional cuts, at its 1974 year. CAA's practice has been to want facilities that under cuts contemplated by Congress the agency would have to abandon the or that local facility. But Secretary Sinclair Watts is coping along closely with Congress this year and the prospect is that overall cuts in funds for airports, roads, towns and other CAA projects will still drive through Congress without the usual frenzy of local protests against them.

—Katherine Johnson

ARMA

ADVANCED ELECTRONICS FOR CONTROL



U. S. Tests EKCO on Copters

British ground control approach radar is evaluated by ANDR, setting sights on all-weather helicopter flight.

Question, Vix-Early language development program, command helicopter instrument flying on long, straight level, in a joint scheme of the Marine Corps and the Air Navigation Development Board.

The modern evaluation program, which is now going on with the new low-cost British-built EKCO ground control approach radar, is an early move in the broad program of ANDR's flight control Navigation Guidance Group. While most of this program still is on paper, it seeks eventually to make it possible for helicopters to continue instrument flight under weather conditions that trouble fixed-wing aircraft.

Net Aeronautics—However, most experienced helicopter pilots will agree they do not use it as an instrument as today's helicopters. The aircraft have much to be desired in the department of stability provided, except in a few cases under out-of-control conditions. Because of the lack of stability, no civil operators have yet been given this country for instrumented helicopter in instrument flight operations. Los Angeles Airways has a restricted clearance permitting its routes to climb through haze under a terminal cloud condition.

Currently, the department is using an web control systems and other instruments specifically adapted to the helicopter. Also new instruments have been added to better stabilization of the rotary wing aircraft, have been demonstrated to be practical for single rotor and tandem machines by the National Advisory Committee for Aeronautics and Navy.

But what it has not established that the helicopter is ready to be controlled by a pilot without conventional flight or without inducing excessive fatigue under instrument conditions, ANDR does not expect to make any instrument flight operations for helicopters.

ANDR spokesman fully expects the present program will be overcome by development new instrument and that eventually helicopter will be able to continue instrument flight operations under weather conditions that would be regarded as near non-existence for fixed wing aircraft.

Further planning calls for assignment of more complete abilities to helicopters and reduction of helicopter traffic from simple instrument approach procedures. Cannot thinking of a pilot flying under instrument approach conditions for helicopter visual flight regulations.

More than 400 miles-controlled pro-



EKCO OPERATOR control aircraft and direction of approachable route on basis of report after approach test. ANR 101

tic approach by Marine helicopter and fixed-wing planes already have been conducted here, using the EKCO ground control approach radar.

The on-air approach, established here for ANDR evaluation tests is first rate cable cannot be designed for its inaccessibility. But recently it operates the same as the EKCO approach radar in the ground and described a Western Week (Dec. 6, 1957 p. 38).

Headquarters—Capt. G. C. Miller, Navy representative on ANDR, says the device is undergoing a modification test that started July 1. This possible modification will be used as a part of the broad program of ANDR's helicopter Navigation Guidance Group. Phase for phase of additional tests in the country will depend on conditions.

U. S. Navy CCA operators are directing the EKCO-instrumented approach. E. K. Cole, Ltd., the British manufacturer, directly has received orders for 25 of the sets from the Royal Air Force at the end of major British evaluation at St. Helier and Bournemouth.

ANDR predicted the U. S. government will spend for \$17,000. General of more complete abilities to helicopters and reduction of helicopter traffic from simple instrument approach procedures. Cannot thinking of a pilot flying under instrument approach conditions for helicopter visual flight regulations.

More than 400 miles-controlled pro-

from 10 to 12 miles at least. It is not designed for continuous instrument flight.

A naturally generated VHF direction finding is linked in with the radar system (think) so that the operator, who he takes a bearing on a transmission from the aircraft, is pointing his three-digit radar beam directly at aircraft toward the plane. It is necessary for the operator to locate aircraft on direction by giving the pilot "steer" and instructing him to fly at a specific safety height until an indication appears on the radar scope. All that the pilot needs is his two-way VHF radio.

The direction radar can pick up the second radio signal at the range of 40 to 50 mi., but the pilot must be allowed to within the 16 miles of radar range of the radar, before his "steer" appears on the scope. The scope is calibrated in two ranges—0.4 miles and 0.15 miles.

OF operators estimate the total set will weigh approximately 1,500 lb. with power supply. He says the set can be brought in by one of an advanced base by one or two large helicopters and set up in a tent within a few hours.

Per civilian use, it is anticipated by ANDR that usage could helpfully be established with the expected growth of civil helicopter transport traffic, and that similar sets can be installed for their use.

ANA Ready to Quit Flying, Reports Say

(McGraw-Hill World News)

Melbourne—Australia. National Airways may be planning to drop out of the airline business, industry observers here again report. Rumors first started in the center is said to be discredited with claims of its own demise, which it afterwards built for commercial airline status. He made the first test flight on more of today's transport and was in early National Air Day winner with claims of its own demise, which it afterwards built for commercial airline status. He made the first test flight on more of today's transport and was in early National Air Day winner with claims of its own demise, which it afterwards built for commercial airline status.

ANA reportedly has prepared consolidation of ANA, TAA and some British carriers as a split of Australian lines, leaving competition to the fifteen Melbourne area. Chance of these plans being accepted is understood to be low.

The palace carrier has ordered its order for Vickers Viscounts, although the government was willing to approve a loss of approximately \$7 million to cover purchase of the helicopter fleet. These were reports ANA would purchase British Viscounts.

Another factor in the strong support of Labor Party sources. The party, if elected, would have right to appoint ANA-TAA and might strengthen the country's civil aviation business.

Aviation Safety

Fresh Approach to Safety Urged

Ben Howard hits stress on crash survival rather than prevention; offers new formula for accident rates.

By Alexander McFarley

A controversial analysis of aviation safety problems is causing widespread discussion within the aviation community and among civil and military aviation users.

Ben O. Howard, veteran engineering test pilot and production consultant, bases his perspective safety study on the statistical relationship of accident frequencies to flight hours. His formulae that the present accepted method of accident analysis on a basis of hours flown is only barely-barely very little relationship to safety factors involved in each flight.

His study shows that only 4.9% of the accidents he analyzed were equipment failure while flying, compared, while 95.1% occurred in beginning or terminal stages of the flight.

Because of this ratio, he finds the most serious accident analysis causes accidents as relation to accident frequency. Each accident is rated as to how far the length in miles or hours flown, results one exposure.

His Design—Howard contends that it is increasingly feasible to reduce crash experience on a basis of its current level. And he makes a case specific design shortcomings which he feels are still being considered in aircraft, despite known as accident causes. The evidence shows an added accident rate because of Howard's analysis. He made the first test flight on more of today's transport and was in early National Air Day winner with claims of its own demise, which it afterwards built for commercial airline status.

More recently, he has said his long in safety engineering, development, operation and production in connection to Douglas and Convair and is present manager of Fairchild Aircraft Division, will be returned to the West Coast.

A paper incorporating Howard's views on aviation safety, the study was scheduled for presentation at the recent New York meeting of the Institute of the Aeronautical Sciences.

At San Diego, Howard told *Aeronautics Week* his analysis of the new federal measure of loss per unit of exposure. "On the basis of the formula, he concludes that in the last 100,000 of our domestic scheduled operating experience, fatality rates per unit of exposure have been reduced only 3.9%.

Howard and he seemed to make it clear that he was "not mad at any-



Ben O. Howard

body," but that his analysis was based on a study only over a period of years, and that his material was limited and subjectively accurate.

Now, Howard-TAA demonstrates his formula, he uses in a basic record of 30,700 domestic military accidents experienced in approximately 80 million flight hours involving 10 billion plane miles and 57,700,000 flight hours. The group involved aircraft 4,100 fatal accidents. He estimates that the analysis indicates while flight fatalities and forced landings, neither are probabilities as severe exposures.

On these grounds, his study indicates that only 4.9% were experienced during cruise, and that the remaining occurred in takeoff and climb to cruising altitude, and on landing, taking, and other procedures required in aircraft flight.

He challenges "the theory of equal safety on a loss per unit as loss per hour basis, instead of the new federal measure of loss per unit of exposure."

On the basis of the formula, he concludes that in the last 100,000 of our domestic scheduled operating experience, fatality rates per unit of exposure have been reduced only 3.9%.

Analysis—Competition—Howard deduced from his accident study that crash rates are proportional to the size and complexity of the airplane, and that crash rates are proportional to the size of the airplane.

Replacement of present DC-8 and DC-4 domestic aircraft with new modern twin and four-engine planes means an increase in the average seats per mile to nearly double, Howard says.

On an equal exposure basis, the DC-7, which is indistinguishable under today's transport requirements, is by far the safest airline transport in general use today, he calculates indicates. This second conclusion on percent airplane safety concepts, he asserts.

Gate Lock Problem—Howard also notes that the accidents which he analyzed have factors to dangerous gate locks, beginning with the last Boeing Flying Fortress Model 299 at Wright Field in 1935, the United States Army DC-4 aircraft at La Guardia Field, and the most recent C-119 crash at Larson AFB in December 1952, which resulted in 55 deaths.

As a result of Civil Aeronautics Board recommendations at the DC-4 crash at La Guardia, Howard says, "I've decided on my ideas of improved corrective action, none of which was even related to a gate lock. Free years later, it was decided to require protection against this hazard by such as new designs and hundreds of DC-4s and DC-6s are still flying without this fairly simple required."

cockpit—Continued. The veteran test pilot claims that nearly 75% of crashes resulting from human error of controls in the cockpit could have been avoided if all airplanes were designed with protection against human-equivalent to human, always based on human mistakes. He estimated that at least a third of all crashes are due to such "human" error.

An airplane model having a higher frequency of a given type of error, whether minor in the same category or below, put in design safety, Howard claims.

"It is up to the designers of the aircraft to devise a machine that can safely tolerate the circumstances to which it will be exposed. . . . ways to handle the expected loads. . . . and cockpit safety should be the expected performance of the man who is to fly it," he says.

Pilot cockpit design, Howard believes, is responsible for 15 factors in many crashes, yet there is too great a tendency to leave the responsibility up to the pilot "to make his crash hit and do things right."

Accidents among accident causes which Howard says can be attributed to on perfecting too much of the pilot's check list is:

• Arranging tailoff with post lock es-

- Retaining gear before becoming airborne.
- Retaining flaps first instead of landing gear, after takeoff.
- Retaining flaps before than engine can accelerate to required flight speed.
- Feathering the wrong propeller.
- Lowering flaps and/or landing gear before plane is slowed down sufficiently.
- Failing to lower flaps or gear before landing.
- Too Fast—Specifically, Howard cites cases of two transports which crashed as a result of flaps being retracted too soon after power loss on one engine during takeoff.

A decreasing rate in the flap retraction speed or too early in the flap retraction control circuit would have averted the accidents.

• **Collision Problem**—The reason that pilot errors that the airplane is the only carrier that does not enjoy a reduction in collision based on its status in part of the vehicle. A new boat named with the Queen Mary as

a collision, but a single pilot plane was and has destroyed a B-15.

Designers must consider that to provide the pilot with anything less than the usability of a pilot's and the flying ability of a pilot, which is to increase collision risk, he says.

• **Number of Crew**—Howard believes that safety improves in ratio to the number of crew members operating in airplane accidents. Ultimate safety goal for him is an airplane designed for maximum operation of all things affecting safety. He feels that, except for cockpit design such as operating in conditions, the crash probability goes up in proportion to the number of people relying on the airplane. He feels that crews will support his argument that the capacity of control is increased when the operation of an airplane requires the assistance of a flight engineer or third crew member.

• **Design Details**—Designers should be required to submit some clearly articulated control circuit, interlock and

aircraft pressure systems, electrical track terminals and such things to prevent their inadvertent waste assembly. Cited are instances of control circuit from the cables around electric cables, and reversed signal-electric pressure lines.

• **Fit Prevention**—Howard wants more emphasis on design for fit prevention after this heavy emphasis on detection and control. Fit must be by double checks and maximum necessary pressure in the fuel line from tanks to engines, and continuing fuel to external tanks which will be flown clear of the airplane in a high rate of deceleration or in a high rate of climb on such stress of greater importance than anything that the passenger will be exposed when the "no smoking" sign goes on.

He reports one case where a short circuit in the "no smoking" sign in a transport caused a serious fire and more damage to the airplane.

• **Crank Protection**—Specifically, Howard feels that more emphasis on crank control is disproportionate to emphasis on prevention of crashes. He asks for re-examination of the backward-looking program.

Given that would be made by a recent airline decision to reduce the number of passengers (United DC-4) to improve chances of survival in a crash, Howard indicates, compared to what could be done by attention to design to eliminate the occurrence of fire and crash.

He calls for a change in regulatory agency philosophy.

"At present," he says, "they are much more concerned over whether or not a safe flight is possible, than they are over whether or not it is probable. They make more laws over the effects of liability on a pilot than over effects of locked controls, engine failure over the takeoff flight path with flaps down over the position the flaps are in during takeoff."

Rules on pilot transformation flights, such as flap-up landings and feathered propeller flights, are concerned by Howard as unnecessary lawsuits which increase air accidents. He cites crashes of these large transports resulting from such practices.

He suggests as a remedy that pilots could practice poking their finger at "red spots" marked on the hangar wall without "the thrill of being dangerously while poking the red lightning bolt."

And he urges the importance of careful screening of pilots, suggesting that Air Line Pilot Act "increase the moral responsibility of maintaining the proficiency and safety of their active membership at the highest possible level."

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eyes of the loop, on its back. These pictures are typical of the superb work done by Prentice aircraft photographers. The Prentice trainer is powered by a 150-hp. Aichi Licentia radial engine.

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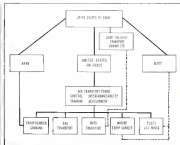
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NEW ORGANIZATION of armed forces air transport resources proposed by Maj. Gen. Turner combines units into a single force under the Joint Chiefs of Staff.

Military Airlift Merger Urged

Cargo expert says air transport resources must be pooled to avoid supply shortages, scattered planes.

A new concept for the organization and utilization of military air transport is advocated by Maj. Gen. William Turner, deputy commander of the Air Materiel Command and former airlift expert of the Clark Group, Berlin (a) and Korean combat cargo.

Generated primarily from his experience as commander of the Combat Cargo Command in the Korean war, Gen. Turner's concept calls for merging of all military transport resources into a single air transport force operating under specific ground mission set by the Joint Chiefs of Staff. The views are expressed in the latest edition of the Air University Quarterly Review, an official USAF publication.

Scattered transport—"During the past several years there have not been sufficient transport planes available to handle all our airlift requirements," Turner wrote. "Planned production and procurement programs indicate this condition will exist well into the future."

"To get maximum utilization of the limited air transport equipment available at this time, all of the best air transport capabilities must be used in the best interests of the country as a whole. Air transport today is scattered among many commands of the Air Force, as well as the Navy and Marine Corps, all of which do not have the same standards of utilization and per-

formance for their use.

"If full consideration of these aircraft into a single command is the most efficient way to do the job, the single command would be charged with the responsibility for airlift according to the urgency of requirements of all the armed services—in other words, the first needs of the nation."

Transport shortage—"Today and in the foreseeable future, instead of an abundance of air transport, we will have a total element in short supply," Turner said. "It is most important that our priority system for its use include all the air transportation available and that its product be made available, according to the situation, to the Army, Navy or Air Force as mission requires."

"I believe that this necessity for a single organization cannot be overstated. Unless this can be achieved, our air transport resources will be far below need in such packages."

Gen. Turner's organization of the single air transport organization—which will include transports now assigned to Strategic Air Command, Transport Command, fleet airlift support wings, MAAG and Marine air transport—should be based on providing three types of airlift:

- Local services within the United States
- Trans-liaison connecting local services



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• **Transport Requirements:** Aircraft to meet these requirements should be designed to be tough and rugged (withstand heavy shocks), easy to fit, easy to install with simple design and a low but fair cost. For the last service, I am not recommending that the conduit be made of copper or brass but of steel. I think the operations would use conduit in the 10 to 25 lbs category with a normal length of 1,500 ft. For the lightest weight, larger amounts are needed with low tonnage costs.

All of these operations should use the same facilities and should be closely integrated under a single management, Gen. Turner urged.

His concepts are based on the organization and operations of the Korean Combat Corps Command and its successors, the 11th Air Division (combat group), in the early days of the Korean war when all transport missions in the Far Eastern Theater were merged under a single command and executed missions on priorities established directly by the theater commander. Strong opposition to the Turner plan can be expected from the Navy, Marines, and USAF commands such as SAC that now maintain their own air transport operations.

SEC Reports Wilson, Talbott Stock Sales

Defense Secretary Charles E. Wilson, former president of General Motors Corp., received 103 shares of GM stock in January in compensation for services rendered in the past, the Securities and Exchange Commission reported. But stock in its monthly official summary for February.

Wilson later sold his total 13,470 shares in this transaction in he did the 21,000 shares of stock in GM Stock, Inc., a holding company and GM subsidiary, as he assumed his new post in Washington. Undersecretary of Defense Roger M. Koss, former GM vice president, acquired 399 shares of GM stock in January in compensation for past services also. He later disposed of his total holdings of 2,942 shares in order to take up his new post.

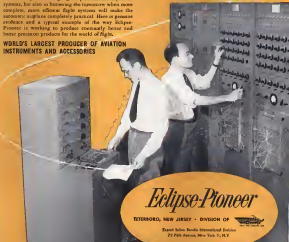
Air Force Secretary Harold E. Talbott is reported by SEC as having disposed of 1,500 shares of Columbia Washington Square Canada stock in January, his total company stock holdings as a director of the Canada.

Richard B. Newell, GM director and general manager of Allison Division, acquired 363 shares of GM stock in January in compensation, giving him total

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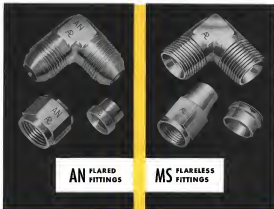
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buildings of 4,508 shares. He also holds 1,245 shares of GM Share, Inc. SEC reports.

Other aviation stock transactions reported by SEC:

• **Air American, Inc.**—Bilbrough Production Inc. bought 1,510 common shares making a total holding of 180,178 shares. Bud M. Baurle, officer, sold his total holdings of 1,510 held in 1958 for \$500.

• **Aeroflex, Inc.**—Aeroflex Corp. sold 16,413 shares leaving a total of 1,641,000 shares. Officers, officers and directors received 24 common shares in a dividend from Aeroflex Corp. making total holdings of 171,013 and 1,641,000 shares.

• **American Airlines, Inc.**—Charles S. Bennett, officer, bought 100 common shares making a total of 1,000 shares.

• **New England Corp.**—J. W. Jackson, officer, bought 1,100 common shares making a total of 1,100 shares. Ralph A. Ward sold 100 common shares leaving him 2,000 common shares.

• **Revere Ship Corp.**—James E. Burns, officer, bought 11,500 common shares giving him total holdings of 11,500 shares.

• **Rockwell Aircraft Corp.**—Officer Ray Borch, officer and director, sold 20,000 common shares, received and sold the same amount 4,000 common shares received at 100 cents from an exercise.

• **United Airlines**—William V. Overman, director, sold 10,000 remaining common shares.

• **United Aircraft & Aircraft Inc.**—Robert A. Shuman, officer and director, sold 100 common shares leaving a total of 1,000.

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Director, sold 6,000 common shares leaving a total of 18,000 shares left over. On 1/1/58, officer and director, sold 100 common shares leaving 1,100 total, and 1/1/58, officer, sold 100 common shares leaving 1,100 common shares.

• **United Aircraft Corp.**—William Clark, officer, sold 100 common shares leaving a total of 1,000.

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Aircraft Design in Transition

It is a time of transition in aircraft design. The ideas that were developed to speed World War II toward its conclusion have almost outlived their usefulness. The nebulous dream of automatic fighters, pilotless bombers and long-range jet transports have yet to become tangible goals.

So designers everywhere are facing the problem posed by interim types, types which combine the better features of ramjets and airplanes, of piloted and pilotless flight, of conventional and new construction.

Spurred on by the undefined implications of the Korean conflict, these engineers are looking at new

ways to reach the tough performance goals set by the requirements of the jet era.

These advanced ideas cut a south coast driving board from layout to detailing. They embrace new aerodynamic concepts, advanced structural analysis, and perceptual innovations.

Some of these schemes—the hybridized, the bypass engine, the crescent wing—were reviewed in the issue of Nov. 15, 1951, p. 21. With this article, *Aviation Week's* Engineering Editor, David A. Anderson, continues his analysis of what lies ahead, with discussion of design and engineering needs of tomorrow's fighter-interceptor.

The Interim Interceptor: An Analysis

- How will engineers link today's piloted fighters and tomorrow's automatic craft and guided missiles?
- Some predictions: with tailless deltas, turbojets plus afterburners, and integral design.

By David A. Anderson

Here is how new ideas could change the face of tomorrow's aircraft designs. For one specific example, take the fighter-interceptor.

A typical interceptor remains to be defined simply in its execution of the mission that calls for complex technology.

Once alerted, the intercepting aircraft must seek out, maneuver, track, identify, and destroy its target. It must do this in the plane, man or machine, in any weather, in any climate, by night or day.

Because of its cloak and destructive power, no precise adjustments to such a mission, an interceptor is going to be light and carry heavy armament. It will be the target and (holding a well-earned lot of enemy equipment) rapid take off and climb will demand a high thrust-to-weight ratio.

So the designer's problem is to take all these things, add a well-protected pilot to maintain the whole procedure and to take care of it when machines fail, and enclose the works in the smallest possible package.

It's the packaging job that poses the real problem.

► **How to Begin:** In times past, the designer has had some kind of an idea as to what plane an airplane shape that he knew would prove over the years,

or a favorite French curve for the fuselage line. There may have been restrictions on components, too, some wing panels from an earlier fighter could be adapted. Or a whole airplane may have been selected and modified until only fairly recognizable.

But tomorrow's designer may have to wait for the answer from a computer.

Suppose that the design is being developed to create a particular class of high-altitude bomber with high subsonic speeds. Instead of going through the ordinary procedure which has so long been typical of design practice, the target characteristics and sets of typical interceptor characteristics are fed into a computing machine which gives out the type of types of interceptors that will be able to shoot down the target.

The computer does not design these airplanes, but merely specifies that with such a perceptual you will need such a wing loading and such a maximum drag coefficient, and so on.

Conceive has done this kind of a study for families of bombers, and has developed a large reference frame of parameters from which can be taken a set of characteristics to solve any particular requirement. The same technique could be applied to the selection of any type of aircraft.

► **Aerodynamic Shape:** Almost now, where the aerodynamic team will get called into the picture. They will have

two major problems. First, to select the correct wing shape and thickness determine the aerodynamic layout, and second, to select the proper kind of inlet and ducting for the engine air.

In wings, there is not much choice. The criterion is thickness, and you can get a thin wing today in straight, swept or delta form. Computer power will have something to say about the choice, and availability of production tooling will also have a bearing.

But there is no doubt that the delta will receive a large share of the attention. Acceptance of the delta layout was the outstanding feature of the year past report (*Aviation Week* Mar. 1, p. 150).

There are indications that the upcoming generation of fighters will be powered heavily on the delta wing—a delta shape of high sweep angles leading through some speed into the low supersonic range. There is a first that advantage, however, it is weight studies made years and ahead. The delta wing can be built stronger and stiffer for the same weight of structure than other wing forms.

► **Tailed or Tailless:** There are two schools of thought on the question of tailless and tail with a delta layout. In England, proponents of the delta point out that you need a tail for precise control and maneuverability. Thus a tail appears on the Gloster Javelin 40—fourth fighter and does not show on the Avon 550 design bomber, which presumably would be called on to perform the greatest a fighter would.

In the United States, proponents of the delta have produced fighters with out horizontal tails—Convair F102,



CONVIAIR XF102A is possible outgrowth of future U. S. interceptors combining small size, delta wing and jet with afterburner.

F2H-1 and the Douglas F4D-1—which are expected to be maneuverable and possibly maneuverable.

But a horizontal tail undeniably adds weight, and that is its own structure and added to the additional structure required to mount and carry its loads. The high lift-to-drag ratio in fact for the tail layout is a natural for fighter machines.

So the trend in this country is to have the tail off.

► **Letting Air In:** There isn't much choice about an intake for the fighter. The requirement is that the intake be as close to the low of the craft as possible. The pilot inlet of the F102 and the F86 Sabre are good examples.

But you have a lot of choice for the case of the interceptor and in the direct inlet may not be needed. Maybe you want to understand the intake, as North American has done with the F102. Or you might go to check-out your entrance like those developed on the North American F86A.

At one time, NACA and others were interested in the problem of inlet slots for high-speed fighters. These were generally simple types, located toward the leading edge.

One example was used by Avon in the F67 and N708 delta test vehicles. But Convair, including Avon, was aware that the positive vents against any kind of decent pressure recovery in the engine and the one inlet was abandoned.

It seems as if the interceptor will have either an embedded intake or a check-out-point of intake.

► **Powerplant Choice:** The designer needs an engine with high thrust and high weight and here the choice is a difficult one.

Lightest engine per pound of thrust is the rocket engine, but the weight of engine jet 1:1 to supply back thrust



REPUBLIC XF-51 with powerful rocket motor and jet plus afterburner is another approach.



TUNNEL TESTS at Convair F102 project, XF102A version, give impetus to delta choice.

over even a short period of time is appalling. Avon's 110-mm rocket with a 18,000-lb-thrust rocket motor. You will calculate that the fuel needed a starting tank 18,000 lb.

Further down the heavy scale is the afterburner, you might end with a total horsepower (actual weight) of about 10,000 lb., less than the fuel weight alone for the weight and fuel under

With a turbojet plus an afterburner, the fuel consumption can be reduced further and the total fuel load for the mission might then drop to around 3,000 or 4,000 lb. Then adding in the weight of the turbojet itself plus the afterburner, you might end with a total horsepower (actual weight) of about 10,000 lb., less than the fuel weight alone for the weight and fuel under



Is compact design your problem? here's how portable electric tool manufacturers solve it with **NEEDLE BEARINGS**

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Since it was introduced nearly twenty years ago, many manufacturers throughout industry have made the Torrington Needle Bearing "standard equipment" for products requiring an anti-friction bearing that's light, compact and has high rated radial capacity.

Why not find out how Torrington Needle Bearings can be used to advantage in your products?

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and guided needles. According to the advocates of each system, each is the best.

But which way is the wind really blowing?

Today's top fighters, the F-86 Sabre, is being built with 50 oil machine guns with an electric gunnery system doing the "dog work." That seems to be the obvious clue—if the engine that counts, and is thereby all you need to do is get a single 22-cal round between the pilot's seat.

But the current trend is to the unguided rocket as the main battery. About two dozen of the little folding 66 jets can be packed into a missile on the wingtip (F-86D Scorpion) or even an airplane instead of a missile (F-94C Starline). They can also be slung in a retractable rack underneath the fuselage belly (F-86D Sabre).

Disadvantage is the lack of terminal guidance, which can be solved because of the dimensions. Apparently the aerodynamic characteristics of finned rockets leave much to be desired. All the available means of advice in the air ahead of the plane view the missile heading only approximately toward the target.

The answer here is accurate aerial guidance which at the job of the nightingale, instead of being at the last possible second to reduce physical dimensions.

► **Missiles**—The drive-in missile is one of the brighter spots in the missile program. There is a chance that the Air Force will begin to get some of the Atlas missiles this year, and the Navy has announced that squadrons will be equipped with the Sparrow starting very soon.

The use of these weapons is such that a small fighter would be restricted to carrying about five rounds. Right now, you could expect a kill probability of about 50%, thus two rounds must be fired at each target. This means only two targets per trip.

But with the characteristics and low-weight philosophy which dictates interception design, four missiles should be enough.

Air-to-air missiles should be the main battery of tomorrow's interceptors.

► **Details**—With these characteristics worked out, the design work can begin. Suggest single letter in the detailing of these new airplanes will be the USAF heavy plane program.

This program plan is aimed at the eventual production of airplanes by building large integrated components instead of more little bits and pieces. Designers have been asked to incorporate the same advantages which accrue from acceptance of this basic program, and in selecting members are beginning to design into the program.

Interceptors actually would seem to be a natural type to fit in here, because



AIR INTAKES These typical examples from North American's Sabre line imply covered sections. Flush inlet (top) or underwing (lower left) are likely choices in opposing interceptors. Straight post inlet (lower right) suits solo use.

such planes are greatly wanted in quantity. Attributes of aircraft—although not necessarily pilots—might be high, and the actual number of airplanes needed to defend a metropolitan area—quantity in high ranked order thus considerations.

Large integrated components will be the structural backbone of the latest interceptors.

New materials will come in along the way, after Tensarite, the "wonder" metal, will find increasing use, new plastics for primary structure will see with aluminum and magnesium for the design's consideration.

Metal adhesive—Mell-Bond Adhesive—will probably not be used in these small aircraft. Chief advantage of the adhesive process seems to come in larger aircraft.

► **More Details**—Now each manufacturer as that could not hope to get into the second details which make up an contemporary airplane. The people of this industry now to rough out some of the major trends which will influence the design of one specific type of future airplane.

There are hundreds of problems in designing the cockpit and the controls, in choosing a landing gear and auxiliary systems.

There are modifications born to the drawing boards, in the windtunnel and on the test flights. But basically, the layout which makes it look like a bird

of an airplane are the ones which have been considered here.

This is what the final configuration might be.

The interceptor is a delta-shaped craft powered by 14,000-hp thrust turbojet with an afterburner. The sides are two (check inlet on either side). The pilot sits in a conventional cockpit under a sharp nose, small pointed canopy.

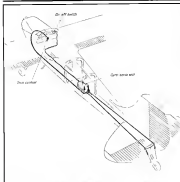
Four ejection seats are mounted on the sides, a pair on each side. These are the six-to-six aircraft which will kill the enemy.

Underneath the smooth skin of the plane are a minimum number of structural parts, fused into shape as one of the big pieces, machined at high speed on new production tools.

That's an interim lighter. It might be the General Electric or the aircraft—acronymically—product of Lockheed or Republic. Its performance will be as precise, its size small and its efficiency high. It will still be flown by a man, although he'll have less and less to do as he approaches the target.

After that one will follow the signals, a natural for the job of interception. It is an advantage that the pilot's craft can never hope to achieve. It could cost him and be operated with higher operational efficiencies.

Meanwhile we have this interim effort. It makes a transition from planned plans to reality. Some day it may be called the last of the fighters.



ANTISPIRAL system has simple on/off switch to enable landing in straight lightplane.

'Automatic Rudder' in Production

Javelin's "antipilot" is low-cost, lightweight unit for keeping lightplanes out of inadvertent spirals.

By Philip Klass

Javelin Aircraft Co. of Wichita has begun delivery of production models of its recently patented low-cost automatic device designed to prevent a lightplane from inadvertently entering a spiral during instrument weather conditions.

The Javelin device, which weighs less than 20 lb. and adds less than \$400, is called a "single-axis automatic pilot" by its manufacturers. However, from an operational viewpoint, it might more appropriately be called an "instrument rudder."

By any name, the device has proved so useful to instrument pilots that Lane, Inc., has decided to enter the field and is currently designing its own entry. Lane now makes a complete three-axis lightplane autopilot, the L-21.

■ The Nuff-Under instrument weather conditions, when a lightplane pilot is disoriented with his charts and radio

aid, the plane may drop a wing and slip into a slow converging spiral with one the pilot being aware of this condition until too late. According to David Rhodes, president of Javelin, 700 people have been killed since 1936, so a unit of this "spiral stability."

One popular type of lightplane, called J-1 instrument weather conditions which Rhodes says can be changed to spiral stability, become the wing



RAVE GYRO, gyro sensor unit and flight cables all are contained in this small, single unit.

switch were fixed at distances up to two miles from the location of the loss. Rhodes concludes that in the spiral begins converging, the pilot was distracted by the increased G's, allowing the load factor to continue to build up until structural failure occurred.

Monsanto Aircraft, Inc., plans to install the new Javelin device standard equipment on its new four-place airplane because it offers cheap insurance against structural failure, Rhodes says.

■ The solution—if a lightplane can be kept in straight flight whenever a pilot drops a wing, the plane's inherent lateral stability will return the wing to level, thus preventing a spiral. The new Javelin device operates in opposite a change in heading whenever the airplane drops a wing. The device does this by spotting a change of engine heading and automatically applying aileron to oppose the change.

In a sense, the Javelin device resembles the yaw dampers found in high speed jets more closely than it does a conventional automatic pilot.

The thing that distinguishes a yaw damper from an autopilot is that the former operates from a rate gyro (or accelerometer) to oppose airplane yawing, whereas the autopilot operates from a rate gyro or magnetic compass reference to hold the airplane on a specific heading.

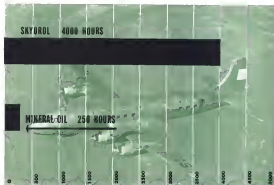
Because the Javelin device uses a rate-type gyro, it cannot maintain the airplane exactly in a pre-set heading in gusty air, although it repeatedly holds heading within a few degrees in smooth air. One advantage in using a rate-type gyro is that it is "drunk-proof" and need never be reset.

■ In Operation—in a Javelin equipped lightplane, the pilot simply leaves the device a patent except that the plane exhibits improved directional stability and occasionally the rudder pedals come back and forth.

If the pilot wants to make a large change in heading, he applies a small amount of rudder pressure to overcome the Javelin device. For small changes in heading, Javelin is providing a small amount of rudder pressure that operates through the servo actuator.

■ How It Works—Except for a pre-set, automatic off-on switch and time control, the complete "single-axis antipilot" is housed in one unit. This unit contains a rate-type gyro that detects airplane yawing motions, and a d.c. servo motor (and reduction gearing) that operates through a lead shaft to deflect the rudder control cables.

Instead of using the conventional magnetic or potentiometer-type pick-off on its rate gyro, Javelin uses two sets of electrical contacts. This eliminates the need for an antispinlock device of electronic synchronization between the gyro and the servo actuator motor.



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thereby control cost and complexity. With any change in plane bending, the gyro slips out or the other of its contacts depending on the direction of the spin which in turn causes one of two motor fields, causing the motor to rotate in a direction to apply counteractive motor deflection.

► **No Contact Problems**—The use of electrical contacts to control the flow of electrical power to a highly inductive load like a motor field frequently causes problems of contact arcing and pitting. Ilmarinen says that this has not been a problem in his device to date. Javelin maintains 1,000 hours of equipment operation without maintenance.

After 1,000 hours, gyro motor brushes will need to be replaced, Ilmarinen says. ► **Future Plans**—Javelin has tested up more than 100 hours of flight time on a Cessna 140 and is currently running tests on a Piper Tri-Pacer which it purchased several months ago. Production of the Javelin device is underway in the Wichita plant recently rented by Mooney Aircraft Co. when Mooney moved to Knoxville, Tenn.

Javelin says that it expects to obtain CAA certification for use of its device with all popular makes and models of lightplanes. This will enable a licensed field mechanic to install the autopilot and merely record time in the log book. For non-light aircraft types, a Form No. 337 (Review and Alteration) must be submitted for CAA approval.



FAR EAST MICROWAVE

Maj. Gen. Paul E. Bauman, commanding general of the Far East Air Logistics Force, makes the first test call on a Plesco 24-channel microwave transmitter recently installed at the 4460th Air Depot Wing in Japan. Microwave networks, which are coming into wider use in both military and civil systems, save the installation and maintenance expense of land lines.



A Boeing test made it easier of firing.

This rocket missile writes a story of the future

With a shattering roar, a test project guided missile takes off for the black silence of space. Its accurate electronic equipment broadcasts data of vital importance back to earth.

Boeing engineers were among the earliest to be assigned a guided missile project at the end of World War II. Their work, which demands a great variety of specialized engineering backgrounds, now goes far beyond research and design on missiles themselves. It

includes the development of complete systems for air defense.

Communications, logistics, maintenance, co-ordination, bases—these are just a few of the many missions of Boeing's over-all activities in this field. In addition, Boeing maintains the services of numerous sub-contractors whose work is part of this huge, more comprehensive developmental program.

Sound research, design and engineering have distinguished a long line

of Boeing aircraft. Today the same accuracy and imagination are dedicated to a broad developmental program in air defense systems. At the same time the company is building the world's E-47 jet jet medium bomber and the great new E-52 night jet heavy bomber. On their own—or considered with all defense systems—such strategic bombers are strong deterrents against attack.

Whatever Boeing develops and builds, you can depend on its integrity.

*Using one of more than one hundred GAPA missile tests by Boeing is shown. These missiles reached speeds of more than 1,000 miles per hour. The GAPA project, completed in 1949, provided valuable knowledge now being utilized by Boeing in a new advanced air defense program.

BOEING

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FILTER CENTER

► **UAL Reuses DC-3 For Radio Test—**United Air Lines has withdrawn a DC-3 from service to begin installation of the experimental weather warning radio system developed by Radio Corporation of America (Aviation Week Dec. 22, 1952, p. 11). One objective of UAL tests will be to evaluate radio penetration ability of proposed 5.7 mc (wavelength) radio. The DC-3 will use an 18-in. dia antenna but no tests will be anticipated to show performance possible with 30-in. dia antenna which would be used at 5.7 mc as adopted.

► **Collins Tests Microwave Field—**Recent interest in the microwave field was fielded at Collins Radio Co. which has a proposal under consideration by a major airline.

► **FID Radio—The** Westinghouse AF-10 search and track radar which has enabled Marine Corps F-84s to down several Red night fighters in Korea "draws from seven years experience with night fighter radar equipment by Westinghouse Electric Co.," a company spokesman says. The radar is now being tested at the Westinghouse Air-Arm Division in Baltimore.

► **Report on AA's Reservoir—**American Airlines' automatic reservoir component, called the Reservoir, handled 4 million "cold" starts to first seven months of operation, according to E. L. Schmitt of Telegraph Corp., which built the device. Schmitt told an AEE audience at the recent national convention in New York that a total of 85 vacuum tubes had been replaced in the 1,500 tube Reservoir during the seven-month period, most of them prior to actual tube failure.

► **Conciliates Tube Failure—**General Instrument Lab, under Signal Corps contract, is now studying vacuum tubes which experience a replacement rate of 2% in more of electronic equipment manufacturers' plants to determine cause of high rejection rate. It studies slowness tube is not at fault. General will analyze equipment for possible misapplication of the tube.

► **Study Auto-Tube Production—**Signal Corps program is studying application of automatic production techniques to manufacture of vacuum tubes. Signal Corps spokesman thinks that automatic production techniques would improve tube reliability by eliminating variable factors due to human operation and by simplifying tube construction to permit automatic assembly.—FK



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Already this division has designed, tested and put into production some outstanding developments. One is the Westinghouse Autopilot, the first automatic pilot to utilize three "iron-humming" gyroscopes and to provide unlimited maneuverability. Also of great value to our nation's military needs are the tremendous advances made on complete fire-control systems and guided missile systems.

These rapid strides were possible because of unmatched resources, such as: a Flight Engineering Department with hangar and company-owned planes... an REAC Analog Computer with flight simulator equipment... an environmental test facilities, such as the one illustrated below... and a large staff of trained service engineers. All these Westinghouse facilities under one roof for one purpose—advancing tomorrow's pushbutton aviation. Westinghouse Electric Corporation, P. O. Box 648, Pittsburgh 30, Pennsylvania.

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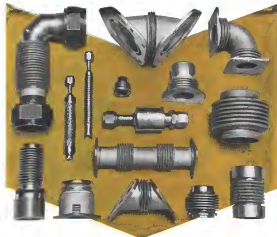
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of metal mesh—each made under
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in metal assemblies—make plastic
assembly methods even more attractive
to customer, Butben said.
• **British Progress-Butben** and British
aircraft development progress, using
Dacron material, is well ahead of
comparable progress in this country.
However, he did not consider Dacron
a better or more reliable material than
American glass fiber-plastic impreg-
nated materials. Butben used asbestos
fiber because of its abundance.
Fibrous glass material is available
in large quantities in this country, and
there is more than enough glass fibers
and phenolics to rebuild the present
U. S. industry and could not meet from
these materials if it is desired. Butben
said.
The engineer reported that during a
recent visit to England he saw a
Dacron duct wing under construc-
tion for a Fawcett K-16/47 research plane
and saw other completed "inlets."
Some British manufacturers are actively
engaged in design and production of
complete guided missile systems
equivalent in size to some of our
smallest fighter planes. Butben an-
nounced Dacron would appear in its
most common use as wing and fusel-
lage of British aircraft and guided
missiles in the next future.—AMC



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gines can be designed in a C-97 or Boeing
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duction lines in Seattle, by means of new ship-
ping mode. Made of steel tubing and 2 in.
12mm, the rods weigh 210 lb each. The
rod, engine, engine was shipped in 1,100 lb
case (development), and only time could be
remanufactured in the C-97. The new design
was dropped by Boeing engineers and
USAF test pilot stationed at the company.



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Accelerated tax amortization for new airplanes expensing their defense built-in is granted by the government in the form of *writeoffs* of property.

In the following list of recent rulings, company name is given, followed by product or service, rate of construction deemed necessary for defense purposes, and the percentage of the expansion cost allowed for fast write-off. Five percent permits property to be depreciated in five years.

• **Johnson Manufacturing Co., Bensenville, Ill.**— aircraft parts 14.14% (1954)
• **Boeing Aircraft Corp., Everett, W. T.**— aircraft parts 10.41% (1954)

• **Endersong Corp., New York, aircraft manufacturing** 12.12% (1954)
• **Boeing Aircraft Corp., Spokane, W. T.**— aircraft manufacturing 10.41% (1954)
• **Yokogawa Electric Corp., Belleville, W. T.**— aircraft parts 10.41% (1954)
• **Boeing Aircraft Corp., Everett, W. T.**— aircraft parts 10.41% (1954)
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Commerce Department's Consolidated Synopsis of Proposed Procurements and Contract Awards Information, heretofore available of local procurement offices, will be distributed on a subscription basis direct to subscribers, effective with the issue of Apr. 1.

Single copies will still be sent for reference purposes to agencies and offices which have received the synopsis in the past. But distribution on a pickup basis to interested individuals will be discontinued.

The subscription price is \$7.00 a year, or \$4.50 for six months. Check or money order, payable to the Treasurer of the United States, should be sent to U. S. Dept. of Commerce, Administrative Service Office, Room 1340, New York City, 415 W. Van Ness St., Chicago 7, Ill.

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EQUIPMENT

Liquid Spring Offers Strut Gains

CPT pushes compressed-oil shock-absorbing gear.
Company sees big future for linear actuators.

By George L. Gerstman

Cleveland-Cleveland Pneumatic Tool Co., now completely owned by its employer, is projecting a three-year development and production drive. Its selected six key target areas are:

- New liquid-spring landing gear.
- Aerial (in-flight) shock struts.
- Aircraft basic actuators.

The company also is actively engaged in research aimed at saving critical materials and replacing machining costs to a minimum.

Liquid Spring.Although Cleveland Pneumatic has been making the Aerial compression aerial shock strut for some time, and the equipment has proved to be rugged and trouble-free, company engineers saw considerable advantages in the use of all-liquid springs, including increased capacity, smaller size, lighter weight.

As far back as 1946 and 1947, company tests showed that compressed oil could give effective springing and damping. Standard AN-656 oil suspension strut when stressed in extension from 0 to 25,000 psi. Application of the principle was blocked by the fact that conventional landing struts would not stand up under the high fluid pressures required.

Dowty Design.The same problem had been heard by Dowty Equipment, Ltd., Chichester, England, and solved with a mechanical unit that can take spring pressures as high as 68,000 psi. The resulting liquid spring shock struts have been used on a number of British and Canadian aircraft, including the English Electric Canberra, the Bristol Brabazon, several Hawker jet fighters, the Avro Canada CF-100 fighter and C-102 jetliner. The Fokker S-11 four-place also uses the liquid spring.

Status of the Dowty liquid-spring shock struts led Cleveland Pneumatic to obtain exclusive American rights for the manufacture and sale of the equipment in 1948. Use of the Cleveland Pneumatic unit is being planned in several new high-performance jet aircraft now on the drawing board.

But, CPT engineers point out, the type of landing gear "offers greatest advantages only when installed in aircraft designed for its use. It is obviously not a cure-all. Many types of

aircraft will continue to be served better by Aerial struts of the presently familiar type."

First U.S. applications of liquid spring struts will be in economic and supersonic fighters where gear storage space is at a premium, CPT asserts.

Main Advantage.Here are some of the features that R. C. Giesey, the company's assistant chief engineer, sees recommending the new type struts:

- **Increased capacity.** Liquid spring struts can be designed for static pressures of 20,000 to 25,000 psi, whereas Aerial struts are designed for the 1,000-1,500-psi range, partly because of the explosive nature of air compressed inside beyond these limits. A 1,500 psi Aerial strut has an extended pressure of 120 psi and a fully compressed pressure of 1,800 psi.
- **Smaller lighter.** The natural pressure means this in terms of size.

The static load on each main gear of a hypothetical 150,000-lb. aircraft would be 64,000 lb. The piston for an Aerial strut for that plane would be 9 inches in diameter and would be housed in a cylinder with 168 in. outside diameter. A liquid spring at 20,000 psi. would support the 64,000-lb. load with a piston only two inches in diameter.

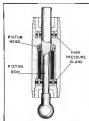
Cleveland engineers are happy about the design flexibility this choice of two different types of gear gives them.

Articulated Cleveland-type shock absorbing units are often used in conjunction with "leveling" rumpetors, an articulated, landing gear configurations. Such installations are used much more extensively abroad than in the U.S.

Cleveland Pneumatic finds that its "leveling, liquid-spring" landing gear offer several advantages:

- **Compact.** The gear may be unusually short and compact because of the relatively short shock absorber struts required for a given diameter of wheel travel. Result is that the gear takes a minimum retracted storage space.

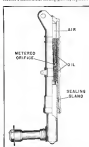
- **Independent axle.** Liquid-spring components of the articulated gear may be a completely independent unit, so can be designed for maximum shock absorber efficiency. Structural considerations are taken care of in the articulated gear assembly proper, and the spring can be viewed as an independent unit.
- **Structural efficiency.** Since support



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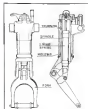
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the gear components proper, they can be designed for maximum structural efficiency.

• **Clear cutouts.** Geometry of the air isolated gear allows all drive, dumping, cushioning and steering mechanisms to be located in the upper section of the gear. Result is that the portion of the shaft protruding into the structure can be of unusually close contour to reduce drag.

• **Softer shock.** Fast that the wheel seats backward (as well as forward) upon initial contact with the ground cuts sudden spin-up shock loads on tires and wheels. These loads are becoming increasingly severe as aircraft weights and landing speeds increase.

• **Conventional Gear-Combination type** means landing gear starts taking the play away from the articulated variety as gear length increases. Conventional Panhard-type units. Vibration in rear gear landing attitude increases under the use of articulated gear inspection. However, this type of shock absorber is used on the main legs of the Fokker 511 four-engine plane.

Most liquid spring main legs are of the combiner type. Although absorbing, at casual glance, a standard Axel gear, these are later different.

• **Order liquid spring cylinders of the cushion type** carries no internal pressure. Therefore, it may be designed exclusively for optimum structural efficiency. Absorption ability such as 7500 is normally used.

• **The piston rod, usually the moving part in an Axel gear, is fixed to the top of the outer housing in the liquid spring type** to keep the piston head stationary. These cushion damping pistons. The moving part in the cylinder which slides between the outer housing and the piston head and rod. Example of static pressure contained within the cylinder is 15,000 psi for the Bertram

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IRCL FORMINGS for B-36 landing gear extension are supplied by Lubbe Co., Milwaukee.



MACHINING by CFF brings rough weight of 8,400 lbs down to 3,120 lbs finished.

noise gear which supports a static load of 114,000 lb.

► **Shawnee Steel-Skill** using the Wehner gear to illustrate a point: Cleveland Precastite says that the steel has a 10.5-in. outside diameter. Steel could be made smaller by using pressure of liquid, or it could be made larger if structural efficiency is desired. Small steel diameter for a comparable steel gear would be 11.6 in. The only change possible in the conventional gear would be to enlarge it. That is an example of flexibility offered by the liquid spring principle.

The slotted shafts allow wheels to be closer to the gear's centerline, and lead to three advantages:

- Less strain. In either case, in two wheel design, the stress lower bending and torsional moments for manual loading loads. In a two-wheel gear, force wheel on each side of the main shaft; this advantage also applies to conventional loading loads.
- Lighter structure. Lower moment of

inertia at transition points lead to lighter machine structure.

► **Decker wheel** with rim lead to lighter self-enclosed, smaller and lighter wheel floor and door opening, axle noise, and extra room for other service. And, the gear attaching into the wing frame, however wings may be designed.

► **Efficiency-Liquid drive** correct oil with a plus action shows efficiency of about 75%. Contrast to the sudden use of adiabatic (no heat added or taken away) air compressors comes in the compression end of the shaft, oil compression curves are very nearly linear.

Comparable overall efficiency with a plus action is closer to 65%.

► **Maintenance-Fit**ing 10,000 20,000 psi steady state a newly different problem than that of pumping up a 3,000-psi Avial. Goodie gear can handle pressures up to 5,000 psi and special equipment can easily be designed to handle higher pressures according to Cleveland Precastite.

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the liquid spring is a non-stressing form, requiring very occasional servicing at open occasions only, the first advantage. Laboratory tests indicate that liquid spring coils work well at low temperature. They are said to be comparable to standard "U" type which will not at -65F and do not lose statically down to -100F.

The company does not anticipate any problems from the fact that liquid spring oil volume decreases with cold, since the same thing happens to the air and oil in Aural strut without giving any trouble.

Start Development—Cleveland Press notes has been designing and manufacturing

Aural struts since 1956.

Once they start the basic acids of shock absorption and support, CPT engineers devoted their attention to weight and size reduction. This led to the construction of aluminum for the struts.

Originally, steel was the best at pulsed-aircraft, SAE 4140 nickel-chromium molybdenum steel, heat treated to 280,000 psi.

As new, stronger aluminum alloys came into existence—1495 and 7581 for pulsed-aluminum gas, a better strength-weight ratio than 4140 steel. These aluminum have a three stage of 80,000-72,000 psi and work against

mostly one-third as much as steel. Therefore, new aluminum alloy class have gained 12% of 280,000 psi but a horrible strength-weight ratio over steel.

Cleveland Pneumatic made, and still makes, aluminum shock absorbers for certain applications. But after CPT took account began re-engineering 4140 steel to the 260,000-250,000 psi stress range, steel again offered the better strength-weight ratio.

Mark Advantages—Significant advantages of fabricating leading gear from the most highly stressed steel are:

- **Weight saving.** Assistant Chief Engineer Casley cites a typical lead, four-cylinder aircraft main gear weighing 1,340 lb and a 4140 main steel being heat treated weighs to 1,510 lb. Using high-stress 4140 steel at least 15% weight is saved on this rise, 225 lb—equal to one passenger and all his baggage, with weight to spare.

- **Higher thrust power.** Aircraft gear takeoff weight may be substantially increased without upping leading gear weight as a result of this steel's greater strength.

- **Disadvantages.**—These advantages are not achieved without paying certain penalties, Casley remarks.

- **Finishing.** The stronger material is extremely difficult to machine, it is difficult to hard in the cutting tools used on it. A considerable amount of work was needed before the proper cutting tools and proper machinery, feeds and speeds were determined. CPT says but the longer, rugged machine tools required to work on very-high-strength steels on the steel used for major landing gear components.

- **High cost.** The finished product costs more than steel and more than 200,000-psi steel or aluminum because of higher machining and tool costs. But Cleveland Pneumatic predicts that costs will drop with continued refinement of machining techniques and increased volume of production.

- **Close Attention.**—Cleveland Press notes has long been making bell bearings, some suitable for aircraft. Recently it decided to go into the design and development of the entire aircraft. First step was to acquire exclusive license to patent rights in an efficient bell bearing system, in this case, the Bellco patents.

Later activities are being undertaken (expected) to expand leading gear members, Gorter told Aviation Week, but CPT solved the problems involved. Cleveland wants to use several generations and at least one experimental plane.

Since applications are under trial on North American F-86 Series, interest in Bellco's control on a Canadian aircraft seat with control on Russian BUC helicopters, and the wingtips

and wing movement activities are Bell's ready-made X-T experience to get jobs. The company also makes the complete Capatronic system for the Bell's F-106, leading gear extension mechanism for the F-7H's wing leads for the Navy's Grumman, and the same components and ball bearings for a dynamic actuating system.

CPT has it supplies a big number of bearing actuating arms, requirements, having units on the 377, B-46, C-97, B-47 and B-52. This actuator division has an order for a complete set of assemblies for one transport modernized and a set of ball screws for another super-sonic model.

CPT designs, as they are as you turn to design electro-mechanical, its design in pneumatic actuation and complete actuating system.

Production Stakes—Cleveland Pneumatic, because of the stress of its work, involving considerable machining of steel and aluminum, has done much to save material and machining costs, only say.

Part of its efforts compare to the USAF heavy press program, because of the use of the forgings and the large leading gear manufacturing by CPT.

USA's heavy press program was designed primarily to produce the forgings, as Cleveland Pneumatic system. Because of CPT's requirements, some of the new press tool have oil drained side rollers which will allow the material's vertical axis to hold forging in a split die while side rollers rotate inside forging barrel over the core.

The ability to produce tubular, hot low forgings in more than 100,000-psi and use important quantities of raw materials and allow a significant reduction in machining time will cutting tool consumption. CPT-designed hollow forgings already placed in production are saving about one million pounds of critical raw material per month, said forgers, according to the company. When the new, heavy press comes into use, permitting forging of still larger pieces. Case savings will become rapidly.

New forging techniques will have to be developed to implement the new, large hollow forging method.

Notes the Future—Brightest spot is Cleveland Pneumatic's future as a company member, in "the short term" certain rapid expansion of ball screw actuator to all kinds of... because of the extremely high efficiency of this kind of actuator... requiring a relatively small amount of power to move a given load.

The design and construction of shock struts for the helicopter (helicopter) equipment supplies also provides interesting future prospects to CPT. Production involved in developing aircraft shock struts could be especially the

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size to those surrounding headline gets—they have to be able to absorb impact loads and must be suitable. Common problem because of soft water will have to be solved, however.

Cleveland Forcemeat Tool Co. was founded in 1894. The original factory had a total area of 600 sq. ft. Today, the company's office and shops occupy over almost 500,000 sq. ft. occupy sq. since 1945 area of land and employing over 2,700 personnel.

Lear Distributors Get New Sales Plan

Lear's Division of Lear, Inc., has set up a new division sales program whereby company salesmen help dealers and distributors get into the firm's Hensel Grand Club.

The program gives its name from the sales target figure of \$100,000 for Lear equipment such as mopeds, semi-trailers, motorcycles, etc.

Salesmen help dealers and distributors set up merchandising programs ranging from light demonstrations to advertising campaigns.



To photograph itself and landing sites of its DC-8s for an automated aerial photo making, American Airlines supply a camera under the air service of one of its planes. Easily detachable tether mount supports the camera which is protected by a sheet metal housing. Camera opens from the nose to allow changing film and focusing of lens. Focus had gone through baggage door to image where the camera sits. AAV closed that pilot, Capt. (Bud) Beckman, had a tough job leading the big ship. The mount had only a 1/2-in. clearance with the ground. The nose wheel extends 14 in. below its normal ground position to allow for shock absorption, during Capt. Beckman has been a foot to the side when landing, as he had to, on his own good feet. He did not scratch the mount once.



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NEW AVIATION PRODUCTS

Navy Studies Anti-Corrosion Gels

Early damage to steel aircraft engines has often been traced to failure of a sealant or preservative to prevent corrosion. This has led to a new specification, MIL-C-15495, and work on new compounds that it is hoped will solve the problem.

"Preserving" is the key to the solution. The word means "damage by touch." New anti-corrosion compounds under study are thioesters.

Previously, a compound which appeared to possess the desired properties as prescribed by the Navy at about the time the seal for it was ordered, neither Joseph Carroll of the Naval Aviation Experimental Station in Philadelphia later tests, developed by Carroll before the Joint Industry Conference on Preservation and Packaging held recently in Camden, N. J., reinforced the belief the compound met those requirements.

Navy's job then became one of developing means of controlling the formulation to assure uniform performance.

Sticks to Job—One formulation the Navy used, aged 30-35 with 1100 oil, tests into a hard gel inside the engine, yet breaks down when shaken or stirred, so that it converts to a liquid as an engine operates.

That is Navy shows it does not demulsify, so have its function, under the action of tropical heat or after extended storage, leaving surfaces unprotected.

For dispersion, the engine is turned manually, causing the compound to revert to liquid form, and it is carried through displacement valves on the lower cylinders of the engine.

To get the compound, the engine is flushed with lubricating oil and the compound burned in the combustion system.

Not used as a heavy engine preservative for long storage, the compound breaks down so well that it may possibly be developed into a shrouded oil preservative, providing better protection than simply replacing the oil.

By now, high penetrators are used for maintenance shop tests protection. Compound Spec—One of the problems met in drawing up specifications was that the compound had to not only adhere to prevent chafe off, but not to the extent that it would clog passages and prevent effective circulation of oil at engine starting.

The new gel is dissolvable only in some respects. A broken down engine structure will rebuild itself as the course

of time, and the reaction takes place without heat. But the new compound must be applied, but to obtain the gel structure, and it will not occur to a solid case, broken down.

Navy tests-Navy tests to determine capability of the compound to prevent corrosion at high temperatures or under extended storage consisted of applying it at 200° to 300° in static test pieces having a fresh surface to an engine cylinder surface.

The coated panels were cooled for 4 hr at 77°F, subjected to direct oil temperature of 140° for 20 hr, then exposed to a humidity cabinet operated at 120° under saturated conditions. The compound protected the panels for 60 days.

Navy is seeking means of improving the tests in the specification, so they more nearly simulate actual field conditions.

The compound presently is suitable for limited in-use application and a 5-oz. engine container and is included in the specification. A number of other teams have used the compound experimentally as a lubricant in flight.



Highspeed Camera

A new camera capable of producing high-speed photos in large negative sizes now gives a method for recording the flight of high altitude rockets and projectiles and photographing wind-tunnel data.

Utilizing a new design, the Heliotek 70 takes twenty-five 5-in. or fifty 2 1/2-in. pictures on 70 mm film at speeds faster than 1/1,200th of a second. A double rotating disk-type focal-plane shutter is used.

The camera has no reciprocating parts, every moving mechanism revolving. The use of the wind-tunnel data to disintegrate conventional camera designs such as shutter and film transport components.

The 12 lb. apparatus is sold without lens, but men have developed lens ranging from 7 to 40 inches. The lens plate

supplied with the camera can be used with an Bausch & Lomb lens 1 1/2 in. with a 2-in. focal length. Focusing is done on a bellows system through a reflex-type viewfinder.

Charles A. Heliotek Co., Inc., 44 Madison Ave., Hampton, Va.



Check Ends Chatter

Chatter caused by excessive cooling is minimized with a new latch check designed so it can be removed up close to the guide bar. This also eliminates need of an adapter, the engine runs.

The check, made by Westcott Check Co., is a low-profile unit that connects on a lathe, and has a check pin and other machine tools with 22-in. 5-thread splines. Overhaul of the part is about 5 in. less than conventional checks, according to the firm.

Westcott Check Co., Orem, N. Y.

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Reeling drive developed for actual application drives threaded rods, or sometimes positioning them to the proper depth below line of cutting and welding pressure plate to provide a firm locking action—Virta Tool Co., Miami St., Farming, Pa.



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AIR TRANSPORT

CAB Splits on Airline Fare Investigation

- Profits "unreasonable," some Board officials say.
- Others call high carrier returns vital to growth.

By Lee Moore

Major airlines are making an all-out effort to persuade Civil Aeronautics Board to drop the General Fare Investigation, slated for hearings May 3. The Board is presently split on the issue. Some CAB officials feel that continuing high airline profits may be "unreasonable," while others agree with the view that these profits are necessary to allow airlines to finance the investigation and to further line cuts.

When profit charged separately last year, three of the present four Board members opposed a 51 fare increase, but they did not agree on the question of raising fares once more by classifying the 15 ownership discount fares then, because has boomed and 1972 profits of the airlines topped their record levels of 1951.

Nearly every airline filed a petition this month asking CAB to dismiss the fare investigation.

• **Sale Maile or Profit Return.** The airlines now urge a profitability approach to airline profit regulation by CAB. They envisaged one of the sales profit margin instead of return on investment as proper standard for "reasonable" airline earnings.

Airlines' overall capitalization in relation to assets still is more like the major carrier business which interests Commerce Commission regulation stands on a sales profit margin than the heavily capitalized railroad and power utilities (which are regulated on an investment-plus basis).

Further, he notes profit margins, these profits are not much out of line with other businesses, says the airlines point out. Present fares are about right. Airline profits are variable. A change now might save the applicant, they say.

So CAB should drop the present revenue investigation, they say.

How are the same detailed returns submitted by most domestic airlines to the Board on petitioning the Board to drop the case.

• **Fares.** The issue is whether fares will go up or down, say Eastern Airlines. The airlines want no change,

Airline Net Profit Margins

(Compared with other government-regulated industries)

	Airline	Rail	Truck	Electric Power
1945	loss	11%	5%	14%
1947	loss	9	5	18
1948	8	8	5	18
1949	5	8	4	23
1950	7	5	4	19
1951	6	6	3	17

Note: Included are domestic trunk airlines, Class 1 motor carriers of passengers, Class 1 motor carriers of property, Class 1 long haul railroads, and Class A and B electric utilities.

Source: Eastern Air Lines petition to dismiss CAB docket No. 550.

according to EAL, and therefore the case is a waste of time and hundreds of thousands of dollars. There is no "rate" the carrier argues, and therefore should be no case. "The Administrative Proceedings Act contemplates that hearings be held only in cases where there are 'issues' involving dispute," EAL says, and it is wasteful for the Board "simply to fix its resources over needless cases."

Eastern proposes a new concept of CAB regulation by profit margin as a standard of investment return. Airline rate of capital investment per year (rate divided by capitalization) is like that of the major carriers. Eastern points out that in 1949 was 14.4% for airlines, 10.2% for bus and 10.6% for trucking companies with 37% for rail and 29% for electric utilities. Net profit margins of airlines and motor carriers are also under the interest rate of 1971. Eastern also notes that airlines' net profit margins were 6.1%, bus 5.4%, trucking 2.5% and electric utilities 17.4%.

• **Airlines.** "The airline industry is now the best kept secret in transportation," says American Airlines. In terms of 1970 dollars, cost of the average ticket is less than 3 cents per mile and quality is much improved. In 1959 a New York-Chicago 6-6-6 ticket cost \$45 and took 4 hr., 15 min. Now average ticket costs \$11, the time takes 1 hr., 15 min., and the service is far better than best-level service of 1959.

"There should be no reduction in a fare level which has not rendered sufficient services to attract equal capital," American argues. Commerce to let

transport will start between 1955 and 1958, AA predicts. The jets will cost \$4 million each, plus \$1.2 million to \$2.0 million each for spare parts. If the jet fleet reaches 30 in 1955, of the ten-engine piston-engine fleet now on hand or on order, the cost will be \$756 to \$873 million. Adding the \$279-million value of present scheduled orders for conventional planes, American predicts capital requirements of more than \$1 billion.

American notes possible sources of that capital. Depreciation reserves are fully adequate, the airline contends, because costs are steady. A DC-8 in 1940 cost \$125,000, DC-6 in 1950, \$220,000, DC-6B in 1951, \$1.2 million, and a DC-7 in 1953, \$3.1 million.

Depreciation reserves available to buy the projected \$1-billion fleet will come to only about \$320 million, American indicates. The remaining \$200-\$300 million must come from other sources and new financing. In 1955, 61% of earnings at the 1951 rate can be accumulated, the airline will need \$538 million of outside financing.

But airline sources do not attract much equity capital, American says. Offering prices of all the airline issues as the seven years 1946-52 total \$197 million. Current market value of nearly 90% of these issues are lower than their original offering prices.

"This almost every airline security issue still is below its original offering price, despite both present price advance and the rise of the stock market. The airline securities market still is weak, American says. From the end of



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projects were begun in an effort to increase "100% all weather plus 'unsold operation'" within a decade.

• Total revenues gained 24% to \$139 million.

• Passenger load factor dropped from 71% to 75% of capacity. But due to a small drop in a 13% increase in total capacity.

• Total unoperated value of UAL's operating equipment and property (excluding \$21 million, recovered from \$136 million at the beginning of 1972 to \$139 million Dec. 31). Net book value of property and equipment gained \$34 million to \$62 million.

• Working capital gained \$14 million, recovering from \$6 million to \$10 million. Long-term debt increased only \$5 million. Biggest sources of net addition to cash during the year were savings, \$10.5 million, and sale of non-convertible preferred stock, \$15 million net. Depreciation, amortization, etc., totaling \$18 million paid for nearly half of the net addition recorded in operating property and equipment during the year. United has spent \$165 million on capital equipment in the past year.

• Total cash of \$34 million paid in 1972 was more than three times the \$10 million (not including) net pay per share for the Post Office to United.

• Dividends on common stock were established for the first time on a 25 cent quarterly basis, plus a special dividend of 50 cents. Total common and preferred dividends of \$1,664,952 came to cash of total earnings.

• Stockholders' return in this financial year is about 18%, slightly more than the 16% a year ago. But net profit margin on sales was less than 5%.

• Question Marks—Among the major uncertainties faced by the company:

- New routes. UAL has completed hearings before the Civil Aeronautics Board, seeking removal of Chicago Northwest route restrictions to enable direct, with Wichita or Atlanta, non-stop service. United, American Airlines and Trans World Airlines are asking CAB permission to compete with each other on remaining overland mid-twentieth century routes operating in three areas: route from Chicago-New York, Chicago-West Coast (Denver route), and New York-West Coast (Salt Lake route). UAL does not comment as to whether price to be made by opening mid-century routes will be offset by increased competition from carriers that may make similar moves on United's present routes.
- General lease suspension. United, through work with other airlines, on period day of possible that cuts that can arise from CAB's General Lease suspension.

• Times. United points out that its average ticket sale was \$47.76. Of that amount, \$10.67 went to direct taxes (\$6.23 transportation tax, \$4.23 income tax and 1.17 other), \$34.21 went for cost of providing the service (including new jetliners, fuel, and \$2.98 was left for net profit on the total \$47.76 for the ticket.

New ACC Chairman Is Commerce Official

The White House has named Commerce Undersecretary for Transportation Robert D. Matson, Jr., as new chairman of the Air Coordinating Committee—the executive agency for civil aviation policy. While House leaders see in ACC in Charles F. Wiley, assistant to Sherman Adams, top White House aide.

Wiley set in on the second ACC meeting under the new Administration. At the first meeting, scheduled for the third week in April, members will face tough agenda (Aviation Week Feb. 21, p. 65).

Matson succeeds CAB chairman Oswald Ross as committee chairman. Ross retains his regular status as ACC member representing CAB.

President Eisenhower has not yet designated the Air Force member of ACC. Two possible Air Force designees are Undersecretary Louis Douglas, a former American Airlines director, and Assistant Secretary Roger Lewis, former Curtiss-Wright Corp. also manager. Meanwhile, Air Force alternate member on USAF Deputy of Civil Aeronautics Melvin M. Warden.

Other ACC members are Earl B. Johnson, Army Undersecretary, John F. Feltner, Navy Assistant Secretary for Air, Paul H. Rogers, State Department, Director of Transport and Communications Policy, H. Chapman Rose, Treasury Assistant Secretary, John C. Allen, Postmaster General, J. McNeil Jones, Budget Bureau associate administrator, and Col. Alvin B. Barber, National Security Resources Board (non-voting).

IATA Copter Meet

(By Gene-Bill Wolf)

San Juan, P. R.—Top ranking U.S. and foreign rotary wing aircraft manufacturers and operators are scheduled to attend a two-day symposium in San Juan, which will stress area of helicopter as passenger transport. The meeting, under the auspices of the International Air Transport Assn., will be held Apr. 20-May 3 at the Caribe Hilton Hotel.

Some 200 IATA members represent-

ing all phases of the industry, including manufacturers, engineering, operations, communication and meteorology are expected to discuss air terminal cooperation or navigation problems and future tactical operations will also be on the agenda.

Pioneer Subsidy

• CAB turns down higher mail rate for Martins.

• Ruling hits local service 2-0-2s and Convairs

Civil Aeronautics Board got back Pioneer Air Lines' management and inventory last week with a unanimous decision denying extra subsidy for the carrier's second stage DC-1s to begin, since expensive Martin 2-0-2s.

The Board set an effective mail rate of 25-40 cents a plane-mile, which will produce \$1,000,000 a year. That is enough to support DC-1 service on Pioneer's route, but is not sufficient for operation of the heavier Martins, or Convairs. The rate is effective as of Apr. 1, 1972, the date Pioneer asked for the change.

Pioneer announced it immediately would suspend those services, and might temporarily suspend all service during transition back to DC-1s.

• Free Warnings. The accompanying findings of the CAB decision imposed some questions of the industry. But the Board opinion reveals that former CAB chairman David Rosen termed Pioneer president Robert Smith last May 7. "It is the current rule of the Board that the income should not be underwritten with mail pay, but being underwritten as a risk of management, as to be additional net per mile."

This statement was not made public by Pioneer to the Board, but a considerable was presented publicly by counsel of the CAB Bureau of Air Operations during the study.

How is what the CAB decision will mean, according to informed observers:

- Pioneer must sell its new Martins and DC-1s.
- DC-1s replacements need not be Martins or Convairs of the present size, CAB believes, because local service is so extremely short-haul, mailfield operation.
- Local lines must stay local—not expand into the mailfield field.
- Bombardier and Combsair are used from the direct of Pioneer competition. Other trunk airlines are second tier service about local service airline experience.
- CAB subsidy policy does not change.

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The Awakening to Safety

Lawrence S. Rockefeller's recent \$75,000 contribution to the Flight Safety Foundation is an important milestone in aviation development. It is recognition from one of America's outstanding men of the importance of safety to aviation. It is also a vote of confidence in a young, forward-looking, non-profit organization that a few years ago was only a gleam in the eye of its founder, Jerome Lederer.

The foundation is dedicated to advancing safety in all branches of commercial and private flying.



Lawrence Rockefeller



Jerome Lederer

Mr. Rockefeller, in making the contribution, said "I feel that the work of the Flight Safety Foundation, which has proven in the past five years to be important to the advancement of aviation safety, should have broad support from the many groups and individuals who are interested in aviation." The promise of substantial contributions which the foundation has already received indicates to me that its objective of an expanded program can and will be achieved.

This added income, the largest contribution to date, will enable the foundation to increase its personnel modestly—from its early seven-man setup.

Mr. Lederer, in recent comments on William Littlewood's annual Wright Memorial lecture, sponsored by the Institute of the Aeronautical Sciences, highlighted the type of realistic thinking the aviation industry is beginning to devote to safety.

"The safe way of doing a job is usually, in the long run, also an economic and efficient way to do it," he said. "Safety is not solely a way to save lives and to prevent suffering. It is also a way to stimulate creation of new wealth and to conserve the wealth we already have."

"No one to my knowledge has developed a workable plan for increasing safety that is acceptable to varying interests. Everyone is for safety just as everyone is against it, and for a time. But expediency and long-term effects weaken our will to be virtuous. Strangely enough, the word 'safety,' except in its absolute sense of freedom from danger, means different things to different people."

"To the airline passenger it means absence of anxiety."

"To manufacturers, safety may mean time with the production line in related stage and payload."

"To the airline vice president in charge of public relations, safety is a word that should seldom be mentioned above a whisper."

"To the newspaper editor, aviation safety is something to be hidden on the last page, along with railroad accidents."

"To all of us in aviation, safety should mean the public acceptance and support of air transportation."

"Mr. Littlewood indicates in strong terms what safety should mean to the engineer."

"He sees it is the prime duty of the engineer to simplify the tasks of the crew so that more can be accomplished with improved safety and efficiency. He criticizes engineers for their tendency to announce device and requirements and other essential factors which cut into range or payload, and he calls attention to the engineer's negative response to safety suggestions."

"He stresses repeatedly the need to design so that failure of a component will not create additional or cumulative hazards, and he does all this in a challenge to the quality and capacity of air transport design engineering."

"These are serious reflections on the design engineer and his interest in safety. I agree with Mr. Littlewood, but the engineer is probably less to be blamed than our educational system and, until recently, the managers of industry, the application and importance of safety, of those dealing with the user in mind. His actions have been explained and properly interpreted to the engineer. Education has been on performance."

"A well-known professor of aeronautics has declared that safety, as yet, is a relatively new concept in engineering curricula, not too seriously considered, if ever, by many instructors. If the industry wants safety, consequences or safety attitudes inculcated into the engineers, industry which has the greatest need put the pressure on the colleges, this conference says."

"The industry has not demanded safety and reliability with the same persistence that it has demanded performance."

"There is a strong trend toward independent safety specialists reporting to both authority."

"These safety specialists, if they report to the management, act as a rallying point for safety-conscious engineers who are not often in a position to bring their criticisms or ideas to the attention of top management. And they are becoming increasingly valuable to industry by educating engineers on the contrast and to think of the device in terms of the other man—the pilot, the mechanic and the passenger."

Aviation's entire future is built on the safe airplane. The stakes, once insignificant, have grown faster than any of us can comprehend. Our aircraft industry at this moment has a backlog of \$17.6 billion. Our U.S. flag domestic and international airlines took in \$1 billion in operating revenues in 1972. Our investment in safety, so far woefully inadequate, is showing slow but sure signs of a rising curve.

—Robert H. Wood



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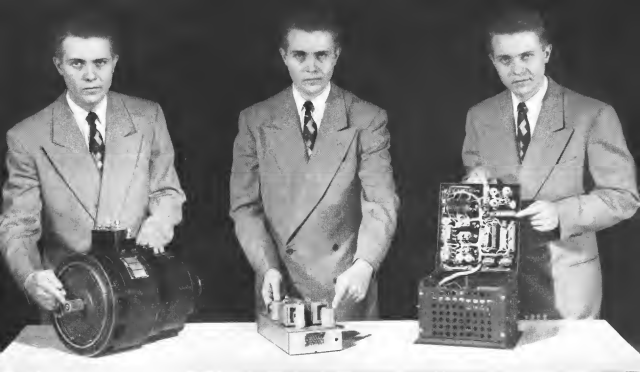
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The "power-package" shown at the top of this page can be teamed with a G-E accessory turbine drive to simplify high-density aircraft design, improve aircraft performance. It can be used with hydraulic drives if specifications do not allow remote ducting. For variable frequency or non-parallel applications, the alternator can be geared directly to the engine. For flexibility, consider:

- G-E alternators are now available in ratings from 15 to 90 kva, for either 40°C or 80°C ambients.
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